Amendments to the Claims:

Please amend the claims as follows. No new matter has been added by way of these amendments. Please cancel claims 1-38.

Listing of the Claims:

This listing of the claims will replace all prior versions, and listings, of the claims in the application.

39. (Original) A method for locating a fracture in an earth formation using a logging tool disposed in a borehole traversing the formation, the tool having a longitudinal axis, comprising:

(a) transmitting electromagnetic energy from a transmitter antenna disposed on the tool with its magnetic moment at an angle with respect to the longitudinal tool axis;

(b) measuring voltage signals detected with a receiver antenna disposed on the tool with its axis at an angle with respect to the longitudinal tool axis, the voltage signals being related to the transmitted electromagnetic energy;

(c) determining a second harmonic associated with the measured voltage signals; and

(d) performing a calculation on the second harmonic to locate the fracture.

40. (Original) The method of claim 39, wherein step (d) includes averaging values computed from real and imaginary parts of the second harmonic.

41. (Original) The method of claim 40, wherein step (d) includes calculating the following equation:

$$\phi_{frac}(f,t,r) = \frac{1}{4}\left(\tan^{-1}\frac{b_{RE2}}{a_{RE2}} + \tan^{-1}\frac{b_{IM2}}{a_{IM2}} \right),$$

where

(f, t, r) corresponds to a voltage signal measurement at frequency f, transmitter antenna t, and receiver antenna r;

ϕ is the angle of the fracture relative to an axis of the measurement antenna; and

a_{RE2}, b_{RE2}, a_{IM2}, b_{IM2} are coefficients corresponding to real and imaginary parts of the second harmonic.

42. (Original) The method of claim 40, wherein the transmitter and receiver antennas are disposed on the tool with their axes parallel to one another and oriented in a transverse plane with respect to the longitudinal tool axis.

43. (Original) The method of claim 39, wherein step (b) comprises measuring voltage signals detected with a plurality of receiver antennas disposed on the tool each with its axis at an angle with respect to the longitudinal tool axis.

44. (Original) The method of claim 43, wherein step (d) includes averaging values computed from real and imaginary parts of the second harmonic.

45. (Original) The method of claim 44, wherein step (d) includes calculating the following equation:

$$\phi_{frac}(f,t,ri) = \frac{1}{4}\left(\tan^{-1}\frac{b_{RE2}}{a_{RE2}} + \tan^{-1}\frac{b_{IM2}}{a_{IM2}}\right)$$

where

(f, t, ri) corresponds to a voltage signal measurement at frequency f, transmitter antenna t, and receiver antenna ri;

ϕ is the angle of the fracture relative to an axis of the measurement antenna; and

a_{RE2}, b_{RE2}, a_{IM2}, b_{IM2} are coefficients corresponding to real and imaginary parts of the second harmonic.

46. (Original) The method of claim 45, wherein step (d) includes calculating the following equation:

$$\frac{1}{N_{rec}}\sum_{i=1}^{Nrec}\phi_{frac}(f,t,ri)$$

where (f, t, ri) corresponds to a measurement at the ith receiver antenna and N_{rec} is the number of receiver antennas.

47. (Original) The method of claim 43, wherein the transmitter and receiver antennas are disposed on the tool with their axes parallel to one another and oriented in a transverse plane with respect to the longitudinal tool axis.

48. (Original) A system for locating a fracture in an earth formation comprising:

a logging tool having a longitudinal axis and adapted for disposal within a borehole traversing the formation;

a transmitter antenna disposed on the tool with its magnetic moment at an angle with respect to the tool axis;

a receiver antenna disposed on the tool with its axis at an angle with respect to the tool axis, the antenna adapted to detect voltage signals associated with electromagnetic energy transmitted by the transmitter antenna;

processing means to determine a second harmonic associated with voltage signals detected with the receiver antenna; and

processing means to perform a calculation on the second harmonic to locate the fracture.

49. (Original) The system of claim 48, wherein the processing means to perform a calculation on the second harmonic comprises means to average values computed from real and imaginary parts of the second harmonic.

50. (Original) The system of claim 49, wherein the processing means to perform a calculation on the second harmonic comprises means to calculate the following equation:

$$\phi_{frac}(f,t,r) = \frac{1}{4}\left(\tan^{-1}\frac{b_{RE2}}{a_{RE2}} + \tan^{-1}\frac{b_{IM2}}{a_{IM2}} \right)$$

where

(f, t, r) corresponds to a voltage signal measurement at frequency f, transmitter antenna t, and receiver antenna r;

ϕ is the angle of the fracture relative to an axis of the measurement antenna; and

a_{RE2}, b_{RE2}, a_{IM2}, b_{IM2} are coefficients corresponding to real and imaginary parts of the second harmonic.

51. (Original) The system of claim 48, wherein the transmitter and receiver antennas are disposed on the tool with their axes parallel to one another and oriented in a transverse plane with respect to the longitudinal tool axis.

52. (Original) The system of claim 48, further comprising a second receiver antenna disposed on the tool with its axis at an angle with respect to the tool axis and said processing means adapted to determine the second harmonic using the voltage signals detected with said receiver antennas.

53. (Original) The system of claim 52, wherein the processing means to perform a calculation on the second harmonic comprises means to average real and imaginary parts of the second harmonic.

54. (Original) The system of claim 53, wherein the processing means to perform a calculation on the second harmonic comprises means to calculate the following equation:

$$\phi_{frac}(f,t,ri) = \frac{1}{4}\left(\tan^{-1}\frac{b_{RE2}}{a_{RE2}} + \tan^{-1}\frac{b_{IM2}}{a_{IM2}}\right)$$

where

(f, t, ri) corresponds to a voltage signal measurement at frequency f, transmitter antenna t, and receiver antenna ri;

ϕ is the angle of the fracture relative to an axis of the measurement antenna; and

a_{RE2}, b_{RE2}, a_{IM2}, b_{IM2} are coefficients corresponding to real and imaginary parts of the second harmonic.

55. (Original) The system of claim 54, wherein the processing means to perform a calculation on the second harmonic comprises means to calculate the following equation:

$$\frac{1}{N_{rec}}\sum_{i=1}^{Nrec}\phi_{frac}(f,t,ri)$$

where (f, t, ri) corresponds to a measurement at the ith receiver antenna and N_{rec} is the number of receiver antennas.

56. (Original) The system of claim 52, wherein the transmitter and receiver antennas are disposed on the tool with their axes parallel to one another and oriented in a transverse plane with respect to the longitudinal tool axis.